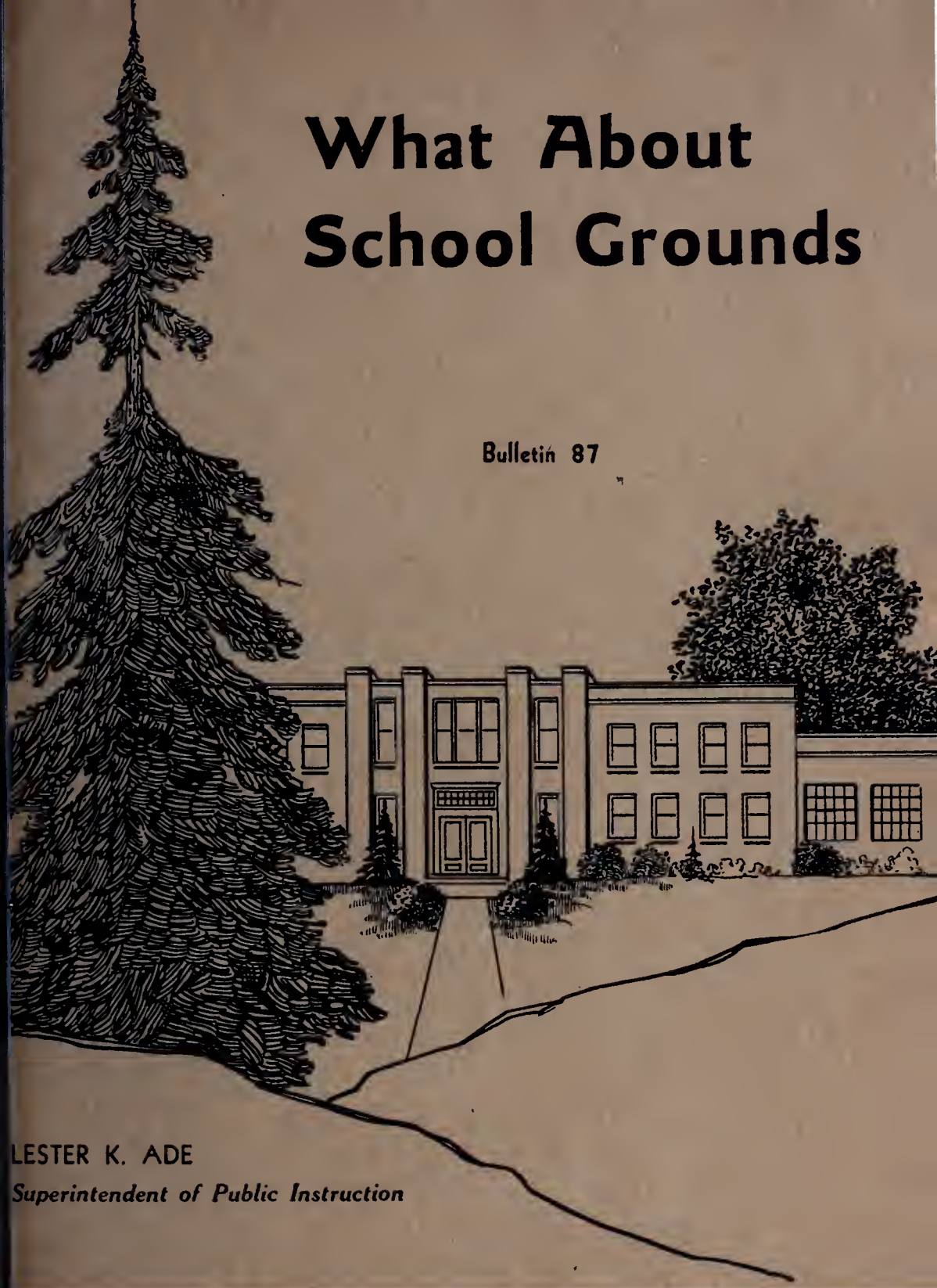
What About School Grounds

Bulletin 87



LESTER K. ADE
Superintendent of Public Instruction

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION
HARRISBURG 1939

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(Continued inside back cover)

WHAT ABOUT SCHOOL GROUNDS

Their Planning and Planting

Every School in A Park

Bulletin 87

LESTER K. ADE
Superintendent of Public Instruction

Commonwealth of Pennsylvania
Harrisburg, 1939

One of Pennsylvania's Recently Constructed Elementary Schools Showing Attractive Landscaping and Beautiful Setting

FOREWORD

The importance of attractive school grounds can hardly be over-emphasized in connection with a new and improved school building construction program. Throughout Pennsylvania there appears evidence of the need of assistance in the planning and improving layouts and planting arrangements of school grounds. The need of suggestions and guidance in the selection and cultivation of various kinds of plantings is also appealing. There are existing examples where considerable thought and time given to such problems has produced school buildings and their grounds of pleasing appearance and enhanced values.

This bulletin is designed for the use of teachers, principals, members of school boards, and community leaders. It is organized as a manual with the subject-matter arranged to give comprehensively fundamental principles and practices of the profession of the landscape architect in relation to the improvement, beautification, and development of school grounds.

The School Plant Division of the Department functions within the Bureau of Administration under the direction of Dr. Donald P. Davis. The present bulletin was prepared under the direction of Dr. HuBert C. Eicher, Chief of the Division, by Mr. Francis J. Mulvihill, who served the Department for a time as Adviser, with special reference to planning school grounds.

LESTER K. ADE
Superintendent of Public Instruction

April, 1939

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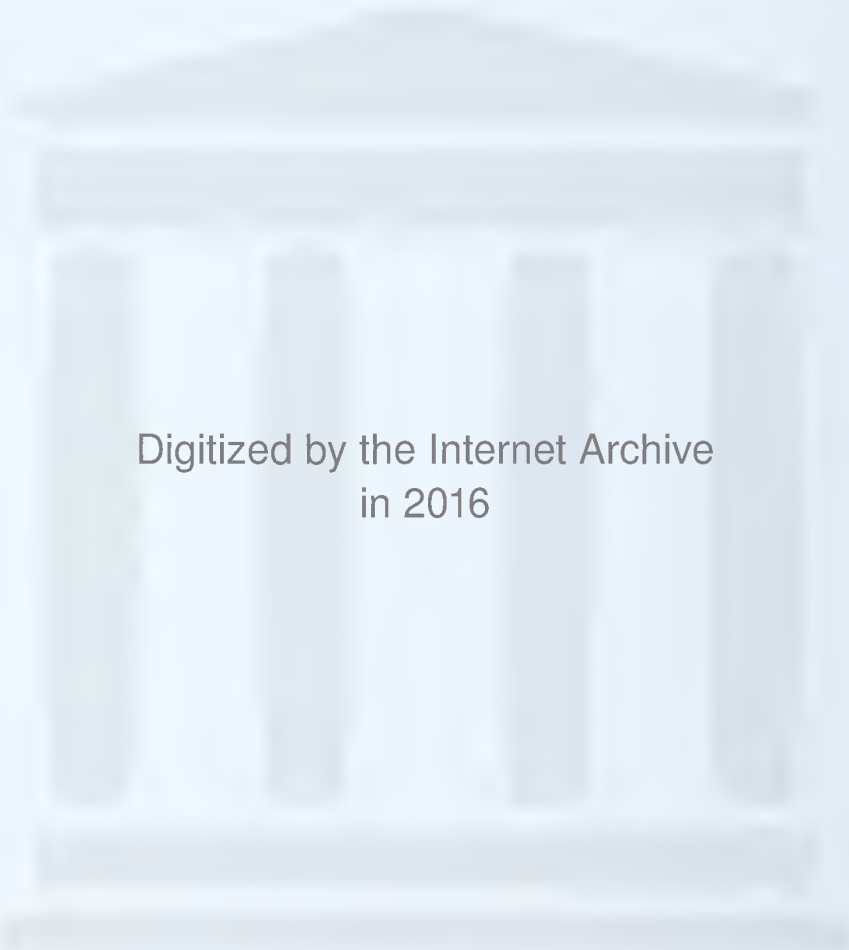

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I. INTRODUCTORY

A community can be judged by the school ground it keeps just as surely as we can judge a man by the company he keeps.

The alive and growing community has attractive school grounds.

More than several hundred new and improved school buildings are necessary to fill the educational needs in Pennsylvania. Modern times demand modern schools and new importance is given to the question—What About School Grounds; their planning and planting?

School grounds should be as carefully planned as the school building. In the development of school grounds the effect should be park-like. The ultimate objective to be attained is—Every School in a Park.

1. Allied Professions Engaged

Consideration of the landscape treatment in the earliest phases of the work in the planning of new schools is important. The school authorities by engaging the professional services of architects, engineers, and landscape architects are recognizing the advantages gained for all, including the community. Each profession in solving the respective problems is benefited by the others in cooperation. All can appreciate a working philosophy of education in modern times. They can perceive that the general welfare of our American democracy involves a corporate society in which each member through cooperative effort builds a social structure in which individual objectives such as personal worth, human values, physical and mental balance, social cooperation, cultural improvement, wholesome recreation, vocational responsibility, and character building may be most adequately realized.

2. Keynotes of Education

An informal, cheerful, and pleasant atmosphere with ample opportunity for systematic, harmonious, natural, and complete development of the whole child characterizes the modern school.

Experiences such as opportunities for individual development, elimination of fear, the consciousness of the teacher as a helper rather than a taskmaster, happy motivated work with wholesome relationships in attractive surroundings are in the definition of the modern school.

Student activity and experience, growth activity leading to further activity, student initiative, self expression, the school as a miniature of society, varied sense impressions, and a flexible administrative scheme are progressively stressed by the "new school" and its leaders.

Life, freedom, nature, self interests, satisfaction, curiosity, happiness, natural environment, activities, and experiences are emphasized in the new education.

Construct, report, describe, discuss, write up, show, compare, contrast, explain, prove, point out, give reasons for, give causes and results, advance arguments for or against topics under discussion by the group are among the methods of the modern teacher.

3. Trends and the Future

Today shows a marked improvement over the past. Teachers are better qualified, buildings are adapted to the program of instruction, administration is relatively efficient, and the educational program has been considerably enlarged and enriched. Current trends indicate that education and the school of today will develop into a social, cultural, and civic community center with activities adapted to the needs of individuals from infancy to old age. It is entirely likely that the future curriculum in order to meet the demand for complete human living will deal with subjects of government, industry, trade, commerce, housing, clothing, food, health, recreation, human relations, natural resources, and individual rights.

II. SELECTING THE PROPERTY

1. Survey Basis—County System

The construction of hundreds of new and improved school buildings in locations where needed has been determined on the basis of long-range survey including population trends, economic and social trends, and the education program required for the children, youth, and adults of each particular community.

New school buildings and new school sites must be planned as a part of a permanent county-wide system resulting from careful study and deliberation by the county boards of school directors and the county superintendents.

2. Landscape Planning Begins

The landscape planning of school grounds begins in the early phases of the work when the school authorities have professional landscape services available for consultation, collaboration, and advice. The landscape architect can assist the authorities in choosing the site where several are available. The sites can be viewed and a general analysis can be given in order to determine the topographic and physical possibilities for development in compliance with the requirements. The landscape architect can indicate a preference for the site that adequately meets the requirements leaving to the school authorities the actual choice. It appears better to have a site meet the requirements than to change the requirements to meet the site.

3. School Site Fundamentals

In school building planning the school site is fundamentally important. Its size, the character of the ground, the location of the building, and the space for play are directly related to an adequate play and recreation program and anticipates future additions to the present contemplated school plant.

The time has passed when land that could not be used for any other purpose became a site for a school.

General analysis of the site jointly by the school authorities and the landscape architect will include consideration of the size and shape of the property, the topography, the soil and drainage, views or outlook, accessibility and relation to main and minor roads or highways, and availability of water supply.

4. Size—Shape—Topography

The size of secondary school grounds should be at least twenty acres; junior high schools ten acres for a minimum and elementary school grounds should be no less than five acres. A rectangular shape is preferable to an irregular shape. The proportion of short sides to the long sides would be in the ratio of one to less than two.

The topography should be that of a gentle slope preferably of southern exposure that is facing south. Slightly rolling land has possibilities while a rugged terrain or steep slopes may require considerable construction and grading to adapt it for school ground purposes.

5. Soil and Drainage

Soil that is classified as sandy loam of good agricultural quality containing a normal amount of organic matter is desirable. A plot of ground on a hilly, rough, or rocky site might be well drained, be of adequate size yet unadaptable for playground use, agricultural work, or landscape treatment. The soil of the site should be good and suitable for the growth of the ordinary plants already in the neighborhood. Good soil contributes much to attractive school grounds and proper appearing agricultural experiments offer a means to draw the favorable attention of the people of the community.

Drainage is very important. The property should not have the drainage or seepage of adjoining properties overflowing it. No site should be considered unless it is well drained or can be readily drained at reasonable cost. A wet, swampy piece of land is not only a muddy dirty place but introduces dangers from ground, air and moisture that will prove troublesome to the building and unwholesome to its occupants. Selection of a high hill or a windswept place for the location of a school building is also an error. What is needed is a property comparatively level but so situated that it can be kept dry.

6. Outlook and Access

Views, outlook and vista should be noted, retained, and enhanced as additional gains toward beauty or esthetics. All possible advantage should be taken of a commanding location and views from within and from without the property. Objectionable views from the property can be obliterated by screening.

Accessibility and relationship to main and minor roads and highways is a convenience for the community served by the property. Obviously, the property cannot be used by the community if there is no means to get to it.

7. Water Supply

An abundant and sanitary water supply deserves thoughtful consideration. Maintenance of the grounds requires water. The school plant in its mechanical and heating operations and for fire protection requires water. The school population needs water for drinking, bathing, and in cooking and food preparation. If it is not available an adequate supply of water should be made available.

III. TOPOGRAPHIC SURVEY

1. Existing Conditions Map of Property

The site once selected now requires a topographic survey or map showing the existing features not only as a matter of record but as the basis for all future development of the property. A competent engineer should do this work and prepare the map which should be drawn to scale, have the direction north clearly indicated, show the boundary property lines with their actual distances, bearings, and angles of deflection. Contours should be drawn at intervals of one or two feet properly identified or marked as to elevation and related to a datum or established benchmark of known specific location and elevation above the sea level. The contours should extend beyond the property lines to the property lines at the far side of adjoining roads or highways when such exist. Existing trees five inches or more in diameter or caliper measured one foot above the ground should be accurately located and identified by name of variety. The spread of the branches should be represented by a circle of the proper size to scale about each tree and the elevation of the ground at the base of each tree should be stated. Masses or clumps of shrubs should be located in outline. Ledges of rock outcropping should be appropriately shown. Walks and drives existing should be shown with the elevations or established grades given and the types of material used in their construction noted on the map. After making the map it should be checked for accuracy. What is shown on the survey should represent the true condition existing on the property. The topographic map should be made on tracing cloth from which prints can be made available for use and for study purposes.

IV. GENERAL DESIGN PLAN

The architect with the accord of the school authorities has developed the plans for the building according to the requirements of the educational program and the needs of the community. The topographic survey being available permits the architect and landscape architect to cooperate and work together in determining the location of the building on the property. Both fully recognize and study the problem as one of land planning and utilization of the entire property. The existing conditions shown on the topographic map enable the architect and landscape architect to begin the process of making the general design plan which will be a representation of the property as proposed for final development. Though all the improvements may not be undertaken at once a comprehensive plan can be adhered to in developing the site.

1. Its Value

The general design plan pictures or visualizes graphically the results to be achieved. It gives purpose to action. It is definite. It assures orderly development. It establishes each part in proper relation to the whole. It is also useful in many respects including acquainting the community with the objectives of the enterprise and calming the clash of individual opinion over details. It attracts the support of leadership and enlists cooperative community effort for accomplishment. The general design plan lends itself to long-range execution so that the work can be done over a period of years. It is a guide to the completed development.

2. Land Utilization

Making the general design plan starts a practical demonstration of land utilization. Preliminary study for design recognizes that different parts of the property serve distinct uses, are related to each other, and contribute to the effectiveness of the whole. Consideration of the broad uses of the entire property distinguishes four areas or zones: the area occupied by the school building, the service area, the play area, and the landscape area.

3. Location of Building on Site

The school building and its location dominate the site. It should be so placed as to leave as much space as possible for play. The location should be such as to allow for expansion or making additions. The building should be so located that all rooms used for study and recitation will receive direct sunlight during the day. Rooms for drawing, laboratories, manual preparation, domestic science, or other special work can very well use north light. East light is more desirable than west light. Light from the north or south should be avoided if possible in classrooms. The best results

seem to be obtained when the building is located so that the long axis of the building is north and south or on an axis with the north end at a slight angle toward the east. It need not be located in the center of the property. The building should be set back one hundred or more feet if it fronts on a highway. The location determined by the architect and landscape architect will place the building neither too high nor too low. The building and the location decided upon will be so interrelated that each will appear to fit the other or will fit with a minimum of grading with little change in the natural ground surface. Having determined the location it should be shown on the general design plan.

4. Service, Play, and Landscape Areas

The service area arranged in a court for access to the building and usually at the side and rear of the building is for vehicles for the delivery of supplies, loading and unloading pupils transported by bus, and automobile and bus parking. This area contemplates construction and surfacing of durable material.

The play area will occupy the greater part of the property. The more intensively used portions will be at the rear of the building for convenient access to and exit from the building. This area will have an all weather surface.

The landscape area mainly in front of the building provides the setting for the building. The chief characteristic will be the lawn with trees and shrubbery at the borders.

5. Building Contractor—Coordination

Recognition of the foregoing areas of land utilization as a preliminary to orderly construction and development enables the architect to coordinate and facilitate the work of the building contractor. The property should be protected from damage during construction operations. Because topsoil is valuable no moving of loads of materials of any kind should be permitted over the property without adequate protection. Unless plank runways are provided over which trucks can be operated the soil will be damaged. Areas where construction and grading operations are likely to occur should be stripped of topsoil. The topsoil then should be deposited in piles on the property out of the way of construction in a location as not to retard progress of construction, yet in a place convenient for reconditioning and accessible for future use.

6. Saving Topsoil—Building Operation

The area occupied by the building, the areas for service court, and driveway connecting it to the highway outside and adjacent to the property and the area for play proposed for surfacing near the building area should be stripped of topsoil. This topsoil should be then piled as suggested previously.

The building contractor instead of operating all over the property should confine the building operations to the areas planned for service, parking, and driveways. If these areas as finally intended are completed first materials can be hauled over them and they can be used for storage space. Materials so stored are convenient and accessible for use promptly as needed in all seasons.

V. APPROACHES TO BUILDING

On the general design plan the location and design of the approaches to the school building including walks and drives should be indicated. The necessity for the approaches only adds to their importance, consequently they should be carefully planned. Circulation must be provided for otherwise the school building is not accessible to the community. Foot and vehicular traffic to and from the building should be facilitated on durable and all-weather surfacing.

1. Walk Circuits Building

Safety demands walks for pedestrian or traffic on foot and drives or roadways for vehicles. Walks and drives are separated. A walk on the outside of the building parallel to it generally is desirable. Some prefer it located at such a distance from the building as to permit the planting of shrubbery between the walk and the building. If there is a basement it should have adequate natural lighting usually obtainable by the construction of areaways with protecting guard railings or with less conspicuous suitable gratings. Others prefer the pedestrian walk in the same location as previously expanded in width by extending inward and slightly upward to the building. The advantage of such a treatment is readily appreciated in providing drainage by shedding water away from the building, protecting a well-constructed building foundation from deterioration by water and dampness, assisting the basement to be dry and natural lighted. The ultimate effect in this instance would be that of a paved terrace about the building. This area has been used as the platform for open air band concerts with the building as a sounding board. At times it is a "sun deck." The paved area as a safety factor should not be under-estimated, particularly if the auditorium is located with entrances and exits enabling orderly disbursal of an audience. Other designs might consider a paved terrace along the front of the building and extending beyond either side in line with the outside line of the walk on each side of the building. Between the walks and the sides of the building would be a ground area for shrub planting. Still another design, possibly, would consider a paved terrace the length of the building. In front of the terrace in a lower level would be the front section of the circuit walk. Such an arrangement may be desirable if an entrance

drive comes to the front of the building. The circuit walk or combination of terrace should connect with all building entrances one step down from them.

2. Front Walks

When the property has but one street or highway boundary and the building fronts on and is close and parallel to it, a main walk can be provided at right angle to both on the axis of the building entrance. It may be twelve or fifteen feet in width. If adjoining properties have been developed with sidewalks on the highway front, a sidewalk on the school property should be constructed also. If the building sets back considerably, walks should be constructed from a point near each corner of the property frontage and connect with the circuit walk. Should the property be bounded by a street or road at either or both sides it might be well to consider extensions of the circuit walk at the rear of the building to the side streets. If many pupils are convenienced by an approach at the rear, a rear walk should be be built and connect with the circuit walk.

3. Walks in General

Walks should be located where needed. If not direct they will not be used and grass areas will suffer as a consequence. Some situations will call for straight walks, others curved. All walks should fit into the ground rather than be laid on the surface. While they may serve as channels for their own surface water, they are not gutters. It is not expected that drainage from grass or other areas will pass over them. Water from the walks should not flow over grass areas. The water from walk surfaces will flow to catch-basins at the side of the walks rather than to basins in the walks. The location of each catch-basin partly depends upon the grade or slope of the walks. The steeper the grade the more basins. All walks should be crowned, that is made higher in the center than at the sides. For example, an eight foot walk would be four feet on each side; a cross pitch of an eighth of an inch for each foot would make the center four times one-eighth or total one-half inch higher than the edges. Steps in flights in walks are to be avoided if possible. If a walk is too steep, the use of a single step or two with ramps will make the walk more convenient. A little thought to design will ease angles at walk intersections or junctions, where they join. Corners may be cut back a little or rounded. A greater cut back, using larger curves can produce an area for shrub planting inside.

4. Paths

Consider the walks as the major or main facilities for foot traffic. The minor facilities are furnished by paths as a means of circulation within the grounds. Paths, however, are usually confined to the

area of utilization developed for play. Their function is to make the parts of the play area accessible. In instances they serve as definite boundaries of areas. Directness and utility determine their location.

5. Drives and Roadways

Drives and roadways for vehicles are for approach and service to the building. Fuel and other supplies must be delivered to the building. Certain waste, refuse, and rubbish must be removed from the building. Service entrances to the building usually are at the rear of the building. The necessary access to the building is provided by designing and locating a service court outside and adjacent to the building service entrances. The service court should be wide enough to permit turning a truck. If such space is less than forty feet a truck may require maneuvering to get it in and out.

6. School Bus—Auto Parking

Pupils are escorted to and from school in the school bus or by private passenger automobiles. Persons on school business have automobile conveyance. The use of the building, its auditorium and gymnasium as a community center, directs attention also to providing facilities for the accommodation of the incidental automobile traffic. At the side of the building and joining the service court an area will appear in the general design plan. It may be designed to include the circuit walk at the side of the building for use as the platform for the loading and unloading of school bus and passenger automobiles. The vehicles would not park at the platform. This area, however, does have parking facilities. If the building is used for community activities the area with its parking is a convenience and near the building. Should the area be relatively clear during the pupils' day it may be used as an open play space.

7. Service Court

The service court and parking area should be relatively level. If defined by curb lines adjoining areas in grass will be protected and vehicles will confine their movement to the proper areas. Guard posts or rails may be installed bumper height if the area is not curbed. A choice can be made of various types of guard rails in order to select an appropriate one. The areas should be constructed of durable material and should be designed to support the weights demanded by the traffic loads using them.

8. Connection to Public Road

A roadway on the property to accommodate two lanes of traffic should connect these areas and a public road. The property may

have boundary roads at each of the four sides or at three sides or at two sides forming an approximate right angle or at two sides parallel or front on but one road. A building located near the side property line abutting a road permits a short roadway connection to the abutting road. If no abutting road is at the side property line then a drive should be constructed on the property, near the side property line, connecting the parking area and the service court with the highway at the front property boundary. For most practical purposes and convenience the foregoing treatment appears as a satisfactory way of dealing with the vehicular approach to the building.

9. Front Drive Considered

A drive may be wanted as an approach to the front of the building. With a building well set back, a driveway may enter at one side from a highway along the front property line sweep in a pleasing curve near the front of the building and leave at the other side. Before putting such drive on the general design plan and constructing it some consideration should be given to its actual need. Any drive in front of the building will reduce the lawn area as well as decrease the effectiveness of the landscape setting of the building. With approach already provided to the side of the building a front drive appears to be a luxury and a needless expense. Its two junctions with the fronting highway makes additional traffic hazards in getting from the highway to the school grounds or in leaving the school grounds to get on the highway. "Safety first" also has been adopted by the modern school. A front drive would not be designed for parking automobiles. One of the reasons for setting the building back was to get away from traffic and its distractions. The conclusion appears to be a front drive is not necessary. The safety factor may be sufficient justification for giving no consideration to a drive near or completely around the building.

VI. PLAY AREA

The development of the greater portion of the school ground for play use recognizes that play is a very essential activity of education. The school curriculum now demands extensive play area within the building and outside. The health and physical education program has captured the natural inclination to play, nurtured it, and given play direction to obtain the greatest benefits.

1. Why Play

Play as well as food and sleep is necessary for healthy normal growth. It contributes to vigor of body as well as health of mind. Not only should the school provide adequate facilities for games and sports, but suitable provision for supervision and direction through competent leadership should be furnished.

Children will play; they ought to play; they should be encouraged and equipped for it, and taught how to get the most out of it. Thrown into association with children representing so many different conditions of life in a democracy the individual is subjected to influences of every other one as well as to the spirit of the masses. All play is not equally beneficial. Careful planning and intelligent discernment do much to have those games and sports most helpful and invigorating on the school play areas.

Soundness and vigor of body is a civic asset. Development of soundness and vigor of body in children becomes the basis for sturdy adulthood and productive citizenship. It prepares the child and furnishes that reserve power to withstand possible emergencies in later life, carry the burden, endure the strain, weather the storm, and emerge victorious. When a crisis comes a sturdy body will withstand and surmount it.

Playgrounds with the proper physical education are important for other reasons. Teachers are given additional opportunities to secure the affection and real respect of children by the intimate and free associates afforded through wise direction and tactful supervision of outdoor sports. The fundamental principles of civics and economics can be exemplified and invaluable elements of manners and morals can be inculcated by supervised play. The playground can be made a powerful factor in the mental, moral, and civic development of the school children. The school playground provides an exceptional opportunity during the life of the young to acquire habits of self control, to educate the will, to encourage right thinking and courageous action; to demonstrate lessons in respect for superiors, obedience, and courtesy; to foster clean speech, to develop consideration for the less fortunate, to recognize the need for organization and leadership, to regard the rights of others, to perceive responsibility for duties performed, to realize mutual dependence, to see the virtue and necessity for cooperation. The playground can be an exemplar of self-government in practice. It helps the public school fulfill the purpose for which it was created, —the preparation of youth for citizenship and public service.

2. Layout

The layout or design of the play area depends on a balanced consideration of all the many factors involved. When local conditions are thoroughly studied it is possible to solve the problems in each locality. In selecting the property, the demand was satisfied for adequacy, adaptability, and serviceability of space for recreation and play. The use of the play area makes imperative the selection of portions or sections which will provide areas for small children, for active games, for apparatus, for quiet, and for athletic field.

3. Small Children

The small children's area should be ample. It need not be large. It should be situated conveniently close to the building and may be entered through a gate in the enclosing, unobtrusive low wire fence. While the fence serves as a protection for the youngsters at play, it helps in the administration of the area. It gives the child the sense of ownership, a feeling that the area is its own. As a working unit the area should have a fairly extensive paved area within a narrow border of grass, or better still, low shrubbery. If there are no existing shade trees and none are planted in the narrow border then shade must be provided by constructing a shelter. The play of the small child for the most part is individual in contrast with group activities of older children. Within the paved area are placed special facilities, including sand boxes or pits, tables, and benches at the sides. The greater portion of the paved area remains clear, free, open space in the center and unobstructed to the gate entrance. This clear space is for romping, jumping, skipping, and can be used for ring or circle games with the supervisor's assistance. If apparatus is introduced it will be located at the sides and in a position that children when using it will not be within reach of shade trees. The apparatus may include see-saws or teeters, swings, a slide, and a low simple climbing device or ladder.

4. Active Games

The active game area is about the most important area on the playground. It should be generally level and well drained by gentle sloping to the sides. It should be surfaced. The size may be determined by providing about forty square feet for each child. This space may be centrally located on the grounds and in close proximity to the school building from which it should be accessible. Accommodations are provided in this area for active games, drills, pageants, setting-up exercises. It may be used for brief work-outs in the open air as part of the physical education program conducted in the gymnasium. Various court games such as volley ball, handball, horseshoes, and croquet can be placed at the border of this active game area.

5. Apparatus Area

The apparatus area permits grouping of equipment in a location so that supervision and administration will be complete as it is easy. Essential pieces should be included while keeping in mind that other pieces can be installed as demand warrants. Some authorities would make a two-part division of this area by allotting a portion for boys and a portion for girls. Boys and girls use the same kinds of apparatus. It is possible to group apparatus by type. One group would include the giant stride, gymnasium frame, and other boy types, while the other group would contain the climbing ladder,

merry-go-round, swings, and other less active types for girls. This arrangement permits directed activity to operate when boys for a period have exclusive use of all apparatus or when girls exclusively use all apparatus or when boys use their portion simultaneously with the girls using their portion or when girls and boys at the same time use all the apparatus.

Some, if not most, of the apparatus may be constructed in the school. If the pupil prepares the mechanical drawings and follows them in the carpenter and machine shops his learning by doing furnishes very practical skills and at the same time acquaints him with the use, operation, and care of the apparatus. The apparatus area is generally located at the sides and adjacent to the active game area.

6. Quiet Space

A quiet game area though not absolutely necessary may be provided mainly for its recreation value. Small in size, it would be located near the building at the side, perhaps as a nook in the landscape setting of the building. It is really an outdoor room furnished with seats and tables for quiet games, story telling, handicraft, and study.

7. Athletic Fields

The athletic field requires space. What provisions are to be made for completeness of facilities is a matter that each locality can best determine for itself. A secondary school ground may provide for baseball, football, tennis, field hockey, running track, and other athletic games. Competitive interscholastic athletics certainly is not the reason for the existence of the school. The requirements of development and construction of athletic fields are special and exacting. The subject has to be studied thoroughly and without prejudice. If the job is to be done it should be done right, completely assuming of course, that the community is willing to support a large undertaking of this type. Once installed the maintenance and upkeep should not be permitted to retrogress. Some persons consider it a grave mistake to allow an athletic field assume so much importance. An open play area the size of a baseball field will accommodate for active games several times the number of children than the number of players engaged in a baseball game. Other areas should not be sacrificed for the athletic field. It appears discriminative to supply a tennis court for four players when the same space may be advantageously used for active games of many persons. If space limitations preclude the regulation baseball field then install a playground ball field with a forty-five or thirty-five foot diamond.

All court and ball games should be on relatively level ground. The areas should be graded and well drained with a slope or pitch

of not less than one-half foot for each hundred feet to take care of surface drainage. The relationship of the various areas to the cardinal points of the compass should be considered. When possible it is desirable to have the main axis of each area north and south. The space requirements for organized games and sports for children and for adults is given in separate tabulations following. These are included to facilitate blocking in or allocating the various types of areas on the general design plan. Detail instructions, diagrams, and dimensions for the layout of particular types are available in various publications dealing with games and sports or they can be supplied.

The National Recreation Association tabulation of space requirements for children's organized games and sports follows:

	Dimensions of Play Areas	*Use Dimensions*	*Space Required (Sq. Ft.)*	*Number of Players*
Baseball	75′ diamond	250′ x 250′	62,500	18
Basketball	35′ x 60′	50′ x 75′	3,750	10-12
Clock Golf	circle 20′ to 24′ in diameter	30′ circle	706	any number (4-8)
Croquet	30′ x 60′	30′ x 60′	1,800	any number (4-8)
Field Hockey	150′ x 270′	150′ x 330′	49,500	22
Football	160′ x 360′	180′ x 420′	75,600	22
Handball	20′ x 30′	35′ x 40′	1,400	2 or 4
Horseshoe Pitching	stakes 30′ apart	10′ x 40′	400	2 or 4
Paddle Tennis	18′ x 39′	26′ x 57′	1,482	2 or 4
Playground Ball	45′ diamond	125′ x 125′	15,625	20
	35′ diamond	100′ x 100′	10,000	
Soccer	150′ x 300′	150′ x 360′	54,000	22
Tennis	27′ x 78′ (single) 36′ x 78′ (double)	50′ x 120′	6,000	2 or 4
Tether Tennis	circle 6′ in diameter	20′ x 20′	400	2
Volley Ball	25′ x 50′	40′ x 60′	2,400	12-16

Adults organized games and sports require space as follows:

	Dimensions of Play Areas	*Use Dimensions*	*Space Required (Sq. Ft.)*	*Number of Players*
Baseball	90′ diamond	300′ x 325′ (or more)	97,500	18
Basketball	50′ x 94′ (max.) 35′ x 60′ (min.)	60′ x 100′ (average)	6,000	10
Basketball (Women's)	45′ x 90′	50′ x 100′	5,000	12-18
Boccie	18′ x 62′	30′ x 70′	2,100	2-4
Bowling Green	14′ x 110′ (1 alley)	120′ x 120′	14,400	32-64
Clock Golf	circle 20′-24′ in diameter	30′ circle	706	any number (4-8)
Cricket	wickets 66′ apart	420′ circle	138,545	22

Adults' organized games and sports require space as follows:

	Dimensions of Play Areas	*Use Dimensions*	*Space Required (Sq. Ft.)*	*Number of Players*
Croquet	30′ x 60′	30′ x 60′	1,800	any number (4-8)
Field Hockey	130′ x 270′ (min.) 180′ x 300′ (max.)	180′ x 330′ (average)	59,400	22
Football	160′ x 360′	180′ x 420′	75,600	22
Handball	20′ x 34′	40′ x 50′	2,000	2 or 4
Hand Tennis	16′ x 40′	25′ x 50′	1,250	2 or 4
Horseshoe Pitching	stakes 40′ apart	10′ x 50′	500	2 or 4
Lacrosse	210′ x 450′ (min.) 255′ x 540′ (max.)	250′ x 500′ (average)	125,000	24
Paddle Tennis	18′ x 39′	30′ x 60′	1,800	2 or 4
Playground Ball	35′ or 45′ diamond	150′ x 150′ (or more)	22,500	20
Polo	600′ x 960′	600′ x 960′	576,000	8
Quoits	stakes 54′ apart	25′ x 80′	2,000	2 or 4
Roque	30′ x 60′	30′ x 60′	1,800	4
Shuffleboard	10′ x 40′ to 50′	15′ x 50′ (or longer)	750	2 or 4
Soccer	150′ x 300′ (min.) 300′ x 390′ (max.)	210′ x 360′ (average)	75,600	22
Tennis	27′ x 78′ (single)			2
	36′ x 78′ (double)	60′ x 120′	7,200	4
Tether Tennis	circle 6′ in diameter	20′ x 20′	400	2
Volley Ball	30′ x 60′	50′ x 80′	4,000	12-16

8. Agricultural Plots

Every senior high school offering among its choices agricultural education should designate an area out-of-doors for agricultural practice. A suitable space in the play area of the property may be used for agricultural demonstration plots. Adjoining may be located the nursery for the growing of trees and shrubs for use in planting the school grounds. Plant material including nursery grown stock and collected native material can be transplanted in the nursery and can be allowed to grow to a larger size for a year or two before replanting such material in its final location.

9. Neighborhood Park

As the school and grounds develop and become a community center with social, cultural, and civic activities adapted to the needs of the community, other facilities are possible in the property of ample size. These facilities are attendant to the use of the remaining property, for the most part in a natural state, as a neighborhood park. An existing piece of woodland would be retained. Here the nature trail idea may be developed for the observation and preservation of native wild flowers, shrubs, and trees. A water course may

have possibilities for a bathing beach. An open meadow or pasture with a grove of trees bordering may be used for picnicing, outings, and camping. It may offer somewhere the opportunity for an open air theatre. Fireplaces can be built. Benches and tables may be provided. It appears proper to remember and realize that in a community center the needs of the child, youth, and adult are given full consideration. The community center will make its contribution to "learning is living" as well as to "the art of living together."

10. Fencing

Fencing the entire schoolgrounds is not necessary. Where fences are used they can be confined to the boundary of the play area on all sides and in segregating areas within devoted to different types of play and recreational use. The protection desired is from within the area not from without. On sides abutting streets such a fence is necessary as a safety precaution in preventing children thoughtlessly running into the street, and as a protection of border planting between the fence and the street. The boundary fence in this instance would be set inside the property line ten feet, at least, or as much more depending on the amount of space that can be spared from active recreation. On sides adjacent to alleys or joint property lines the fence may be located to permit a buffer strip or border for the planting of shrubbery and trees. Tennis courts frequently are fenced. Where the back stops or sides coincide with the boundary fence it appears well to take advantage of that situation by the dual purpose fence. Various kinds of fencing have been used. The wire chain fence has much that commends it.

VII. LANDSCAPE AREA

The general design plan has now progressed to the phase requiring consideration of the landscape area as typified by grass or lawn portions, tree, and shrubbery planting. Trees and masses of shrubs already existing on the property possibly could be preserved and incorporated in the design. The inclusion of existing plant materials has the effect of mellowing the treatment and relieving the rawness and newness which the development might have otherwise.

1. Boundary Planting

Where to plant depends upon the local opportunities and conditions. Some shade has been indicated previously in the small children's area, and the quiet area is partly surrounded with planting. Plant materials between units of land for different use may be desired to obtain definition of areas and for landscape effect. Boundary planting is the most important kind of plantation. Such planting should be fairly continuous though it need not be uniform in height. Sections of it used to screen out unsightly neighboring

existing structures need be no higher than to accomplish such screening. The feeling of inclosure for quiet and seclusion can still be had by introducing gaps between planting masses. This interruption of continuity allows capturing desirable views to properties outside the property thereby increasing the apparent extent of the grounds. The breaks tie the grounds to the community but do not separate them. The boundary plantation is made up of shrubs with trees interspersed.

2. Park-like Development

The community and the passers-by get their first impressions of the school grounds from pleasant views into park-like open areas of lawn bordered with plantings of shrubs and trees. That portion of the landscape area in front of the building furnishes such views from the fronting street or highway. Analysis of the picture presents the building in the background; has a middle ground open space of well-kept lawn and a foreground of sightly trees and shapely shrubs. The boundary plantings previously considered have a portion to function as a foreground. The arrangement of plant materials is such that foreground, border planting, and planting of the building all combine to frame the whole picture.

3. Wedding of Building and Ground

Planting of the building is the wedding of the building and the ground upon which the building is located. The building is the dominating feature of the general design plan. Usually the outlines of the building are severe. If the mass of the building is squat the horizontal lines of the roof, understructure, and base will dictate a planting of upright pyramidal forms to obtain a pleasing landscape composition. If upright lines predominate in the building, relief can be had by using for contrast roundheaded masses of planting. Where the facade is one of architectural balance on a main entrance door the balance can be maintained in landscape composition by using the same kinds of plant materials on each. By using different kinds of plants that do not balance rather interesting results can be obtained. The outline, forms, kinds, texture, and quality of plants may differ, but if there is a balance of mass the effect is pleasing, harmonious, and of good design.

4. Treatment of Entrances

The architect in the design of the building has given degrees of accent to distinguish the main entrance from other or minor entrances. The landscape architect continues the accent in his planting. Larger masses are at main entrances with smaller masses at the minor entrances. Except for size, the planting masses are similar in that at each side of an entrance is provided a pyramidal form faced down with smaller roundheaded forms to produce a base.

The school needs natural lighting. After adequate window space has been provided in the design of the building, it appears to be an unpardonable error to obstruct the light with planting in front of windows.

5. Plant Building Corners

Corners furnish opportunity for planting. The vertical line of the corner of the building and the horizontal line of the ground at the base forms a right angle which needs treatment. In order to convince the eyes that the building fits the site, a mass planting is placed at the corner composed of a pyramidal form faced down with lower roundheaded materials. The planting of the building thus far treated constitutes what is termed foundation planting probably because it is at or very close to the building. With a paved terrace or platform at the base of the building the foundation planting must be made on ground beyond the paving. Out from and off the building corners, trees and larger masses of shrubs help to enframe the building. The public comes closer to plants in the locality of the building. The plants are more likely to get the attention of the people here than elsewhere on the grounds. It is appropriate then to select trees and shrubs if desired of the finer, refined, and more costly kind of plant materials for use near the building. Evergreens, both conifers and broad leaf, may be introduced in order to have green the year around. Broad leaf evergreens can be used if the soil and situation will permit their growth. Unfortunately they do not thrive in limestone regions. They require an acid soil, peat or leafmold, and maintenance attention. Corners at walk junctions should be planted. Mass the planting in right proportion to the size of the walk corners. Masses of planting are necessary at junctions of drives with streets or highways. So arrange the planting that traffic approaching the junction can be seen.

6. The Lawn is Open

The broad open space now remaining on the general design plan represents the lawn appearing in the middle ground of the picture as seen from the frontage street looking toward the building. The addition of trees in the open away from the borders of this area will cast interesting shadows on the green. Another purpose of introducing such trees is to give "scale" to the building. The flatness of the lawn can be relieved by this creation of third dimension.

7. Optical Illusions

To some persons a tree is a tree regardless of its being a small tree, a medium size, medium-large, or a large tree. Without attempting to explain the science of optics, objects below the eye or in a plane sloping down appear farther away than they actually are. Looking into a hollow, a small tree in the bottom extends the dis-

tance as well as makes the bottom appear deeper than it actually is. The bottom of a grade will tend to come closer and rise as the size of a tree at the low grade is increased. If the school building is higher than the eye, a small tree in the background with larger trees in the foreground will bring the building down nearer eye level. Small trees in the foreground and large trees in the background create an impression of raising the level and brings the building closer. If the building is small, large trees near it may appear to dwarf the building. A large building with small trees makes the building appear larger and the trees smaller. If the various factors of the local situation are given ample consideration it is possible to select the proper type of planting. Rightly planned, the landscape area especially in front of the building, can have an individuality peculiar to itself.

VIII. DESIGN PLAN COMPLETED

The general design plan is now completed by adding the appropriate title, graphic scale, and north point. The component parts have been labeled. This drawing should be the kind that a skilled draftsman would make, and all labeling of areas and features are in a style of freehand lettering that is clearly legible, in good proportion, and in keeping with the features represented. The drawing made with waterproof black India ink on tracing cloth lends itself to considerable usage and a long life. Everyone does not read a plan with the same ease. Consequently, a picture or show plan will facilitate the whole enterprise.

1. Types of Presentation

From the original cloth tracing general design plan can be obtained prints of various kinds. A black line print on white water color paper is excellent for the purpose of a show plan. This print becomes the basis for a water color rendering. Differentiation of the elements of the design or layout with color helps visualize what is proposed. Displaying it when pleasingly colored, to individuals and organized groups, is one of the means of enlisting and securing the backing of the community needed to make the proposal a reality. In addition to the display plan a perspective drawing can be made from the layout design. The bird's-eye sketch is a three dimensional presentation depicting length, breadth, and height. It is more intelligible to the average person than the display plan. The scale model is the ideal presentation. It is the general design in three dimensions and represents the development in miniature.

IX. A WALL-LESS CLASSROOM

Correctly conceived and properly developed school grounds are an extension of the class rooms into the open air. Nature study and

vocational agricultural studies from textbooks within four walls have greater potentialities when expanded to demonstration in the laboratory of the out-of-doors. Nature study cannot be successful unless it is out-of-doors. Love of nature comes from contact Knowledge of nature precedes and begets love. Frequent, intimate, and sympathetic relationship with nature comes from associations that can be seen, felt, heard, and understood. The forms and moods of nature represented in forest and meadow, trees and plants, hills and valleys, ponds and streams, swimming fish and flying birds, the sky day and night, wind and weather, all these, are open books inviting study and observation that inspire, instruct, and educate. They are the sources of real knowledge and genuine love of nature.

The outdoor laboratory is a proving ground and place for practice and experimentation. The how of, What About Schoolgrounds, their planning and planting can be taught here. Instruction can be given in the steps and processes to be adopted and adapted to aid nature show her powers to produce pleasing forms and colors. Here can be inculcated by actual practice the preparation and improvement of soil for plant growth. The nurturing of seed from sowing through germination and growth to maturity can be realized. Here can be obtained experience in the preparation and care of lawns and the methods of beautifying them with foliage plants. The value of study and planning can be appreciated. The arboretum of native plant materials typical of the locality can be assembled. Conservation methods protecting such materials and controlling their pests can be exemplified.

X. CONSTRUCTION

1. The Construction Plan

The work of construction can be facilitated if a plan is made and followed showing in detail what the master or general design plan shows in general. The construction plan is a permanent record of work and should be drawn to scale. On it the location of the building, drives, walks, play fields, plant areas, and underground utilities are shown. Their widths, distances, and dimensions should be clearly indicated in order to obtain the desired layout.

2. Grading Operations

Grading operations are necessary in construction to create desirable conditions for drainage and relatively level areas where use demands. The construction plan becomes also the grading plan and record of ground changes incident to carrying the plan to final completion. Existing ground elevations and contours should be shown in relationship to proposed grades and contours so that the extent and quantities of cut and fill can be determined. Excessive

cut and fill are to be avoided. Natural slopes and curving surfaces are to be retained as far as practicable. Steep banks and mounds present problems of maintenance and soil erosion. Gulleys occasioned by quick run-off of surface waters can be controlled by grading. Cutting back and rounding the tops of steep slopes and filling in at the base of slopes offer very practical solutions. Low places or pockets where water may collect and stand can be removed by filling. From the grade line of the building to the street or highway a long sagging surface is preferable to an up-turning or convex surface. The landscape treatment of the grounds contemplated is in the natural or informal style. Terraces are therefore to be avoided between the building and street. All play areas including the athletic field should be graded as level as possible consistent with good drainage.

Grading operations should begin with what is known as stripping. The topsoil should be removed or stripped from the surface of all areas where construction and grading operations are to take place. The top six-inch layer of soil is generally recognized as topsoil. Saving topsoil is conservation practiced. After stripping, the topsoil should be stored or piled on the property for later respreading and use after the proper subgrade has been established or made ready. The subgrade is prepared to produce a smooth, firm, and stable surface below finished or final grades. Finished grades are always parallel to the subgrade surfaces.

3. Underground Utilities

Underground utilities are to be installed below subgrade. Systems for water service, separate or combined water and sanitary sewerage, and electric lines should be indicated on the construction plan, and become a record of their location. The location of utilities will avoid interference with other construction and will be clear of tree locations and shrub planting areas.

4. Tile Drainage

Tile drainage should be installed in the relatively level play areas. When so treated such areas dry more quickly and are available for use soon after wet weather. Four-inch tile from two and one-half to three feet deep in ditches twenty feet apart and properly back-filled have been found generally satisfactory for this purpose.

5. Driveways

Driveways should be constructed and designed for the maximum loads that will use them. Local practice or specifications of the State Highway Department may be used. There is a range in cost depending on the type selected because a choice is permitted from gravel, macadam, bituminous, and concrete. A well compacted surface of gravel on a thoroughly rolled eight-inch layer of three-

inch crushed stone is of lower cost and has given satisfaction. Macadam is built up of layers of crushed stone with large size stones at the base to fine screenings at the top. There is no doubt of service and performance that a tar-bound macadam will render. The driveway of concrete is durable and more permanent than other types. It would be well to provide curbing to protect adjacent areas. A combined curb and gutter can be constructed at the same time the roadway is in process. Driveway should be sixteen feet in width to accommodate two lanes of traffic. Single roadway width would be ten feet. The roadway should be crowned, that is have the center higher than the side edges. Water from the surface of the drive should not be drained onto lawn areas. The roadway should be its own channel, and water collecting on it can be conveyed in side gutters to inlets or catch basins connected with the storm drain system.

6. Walks

Walks are built of various materials of different types: brick, flagstone, asphalt, and concrete. Brick is pleasing and can be laid in interesting patterns or designs. Concrete walks appear to be the most desirable. They cost more to construct but have durability which makes them less costly to maintain than gravel or crushed limestone. They lessen maintenance costs within the building itself because less dirt is tracked in. Walks should be six or eight feet wide. If the building is close to the street the main entrance walk connecting both may be widened to twelve or sixteen feet. A concourse so produced in concrete can be made more attractive by including borders or patterns laid in brick. Concrete walks are usually laid on a foundation or base of cinders thoroughly compacted. When the walks have been constructed the finished grade of their surface may be above the subgrade of the area adjoining. To protect the walk structure soil should be temporarily placed at the walk edge on the adjoining subgrade. This will divert surface water which otherwise might wash out the foundation and undermine the walk surface. When all surfaces are finished the walks will be slightly below the lawns adjoining. Drainage is provided for each, consequently walks will not drain on lawns and lawns will not drain on walks. The center of walks should be higher than the sides. Catch basins for walk surface drainage are not to be located in the walks, but rather in gutters at the side. If gutters are omitted catch basins will be located in the lawn area beside the walks.

7. Play Areas

Play area construction appears to be diversified. Layouts of areas for games, dimensions for location of lining, position of bases, goals, baskets, backstops, and nets can be had on reference to many publications or from the person in charge of the physical education and athletics program of the school.

8. No Standard Surfacing

Surfacing that is ideal or satisfactory for every ground has not yet been devised. Play area surfacing which will meet all requirements is a problem which remains to be solved. Different parts of play areas require different kinds of surfacing. Different soils and physical condition produce special problems. A quarter-mile cinder and clay track with a 220-yard straightaway on a crushed stone base surrounding a combination football field and baseball diamond on a twelve-inch sodded layer of topsoil furnished with tile drainage may prove very satisfactory.

Grass has been usually accepted as the best surfacing on play fields for general purposes. The size of area and the intensity of use determines to what extent grass can be maintained. Intensive use may make necessary providing a more durable type of surface.

9. Much Experimentation

Considerable experimentation has resulted from the necessity to find the proper materials for foundations and surfaces for many special sports. Natural or prepared mixtures of sand, clay, and gravel or crushed stone are commonly employed. To avoid the nuisance of dust, calcium chloride has been utilized on dirt surface. Portland Cement and bituminous products have been added to obtain stability of surfaces.

Tennis courts are constructed with a sand-clay surface. There is a trend toward asphalt and concrete surfacing, with a distinct tendency for asphalt. Courts of such impervious materials require less maintenance and certainly lend themselves to intensive use and quickly dry after a rain. Many persons prefer other materials for tennis court surfacing, but use of concrete for handball courts is quite general. A tennis court or other relatively hard surface for outdoor sports should be laid on porous material of cinder or gravel, with adequate provision for drainage away to prevent the possible collection of water which upon freezing can cause considerable damage to the surfacing.

10. Asphalt Surfacing

Asphalt surfaces include the following more common types: cutback asphalt, tar, asphalt or tar emulsions mixed with clay or stone chips, hot mixed asphalt, rock asphalt (laid cold), and mixtures of sawdust and asphalt. Less common mixtures under trade names have widespread use. Such proprietary mixtures generally contain a bituminous or tar binder with a fibrous substance as a filler. Bituminous surfaces are constructed in various thicknesses, three-quarters of an inch to one and one-half inches, dependent on the stability and physical properties of the foundation course or courses.

11. Foundation Materials

Foundation materials include: sand, gravel, cinders, furnace slag, crushed stone, or brickbats laid in layers several inches thick. Unequal resistance of the sub-base where soil conditions are unstable may require a concrete foundation to prevent settling or warping of the surface. The surfacing in this instance would be laid on the concrete foundation.

Hot mixed asphalts prepared according to specifications can be obtained from plants equipped for the purpose. Many types of bituminous surfacing can be prepared at the site of the work. In the use of Portland Cement, the methods and specifications of State highway departments and recognized authorities can be used. The specifications of the manufacturers have been followed in the use of trade products and the methods of application have been supervised by the manufacturers' representative.

12. Successful Surfacing Example

A surfacing that has proved successful was prepared as follows: on a firm and stable sub-grade, clean cinders were filled in. The cinders, not exceeding two inches in diameter, were spread uniformly in a layer three inches thick, wet and rolled with a suitable roller until no waves appeared in front of the roller. Care was taken to have the completed surface of this course parallel to the sub-grade and to the finished grade. This first course was again wet before the second course was applied. The second course, consisting of three inches of limestone screenings and dust was spread evenly over the first course and rolled with a suitable roller and wet between the rollings until a smooth compact surface resulted. The third course was spread evenly over the second course by using calcium chloride at the rate of one and one-half pounds for each square yard. An evenly spread layer of coarse or torpedo sand thoroughly rolled makes the fourth course at finished grade. Those desiring to experiment may divide the play area into equal sections for surfacing treatment with Kentucky rock asphalt, penetration tar macadam, emulsified asphalt, premixed tar with tar-seal coat, and premixed tar with asphalt-seal coat. Such treatment may afford comparison of the various types under identical conditions.

Construction outside the school building has been completed including walks, drives, and surfacing in play areas, according to the construction plan. The development of the remaining area, the landscape area, will be also in accordance with a plan of planting.

XI. PLANTING

1. The Planting Plan

The planting plan is a translation of the general idea and design of the master show plan into specific and precise detail for development. A record of planting, an India ink drawing on tracing cloth

is necessary, and the planting plan should be that record. The planting plan should show the location of all trees, existing and proposed, and their common or scientific names or both. It should give the names, quantities, and sizes of shrubs selected for use. It should show the location and outline of all shrub beds within the property and comprising the border or boundary plantings. The outline of all beds is to be in curves when abutting the lawn area. Beds adjacent to walks should be separated by a grass or sod strip at least two feet wide to permit the use of a lawn mower on such strip. The line of the bed should be parallel to the walk edge. If a walk is straight the line of the bed would be straight. If the walk is curved the bed line would be curved.

2. Spacing and Location of Plants

Spacing and location of each plant in a bed may be indicated on the plan. The desire for immediate effect tends to locate plants too close. Upon growing they become crowded and fail to appear true to form. The situation can be overcome later by removing a plant or two and rearranging the plants remaining in the bed.

3. Native Materials

Native plant materials should be used as far as possible. Considerable interest, variety, and relief from monotony in planting can be had according to choice and selection of materials. Materials may be chosen according to: color of flower; color of bark; color of fruit; attractiveness to birds; color of leaf, particularly autumn coloration; endurance to shade; liking for full sun; preference for dry soil; thriving in wet soil; withstanding neglect; requiring little pruning; freedom from insect pests and plant diseases; size; form; texture, and use as specimen.

4. Sources of Information

Practically, in every community there is at least one, if not several persons, a garden club member, a lover of the out-of-doors, a student of plants, a teacher, who can name, point out, identify, and furnish reliable information relative to trees and shrubs that are common along the roadside, in woodlots, bordering streams, and in pasture lands, in his neighborhood. See those common materials and try to visualize how they would appear when massed or grouped on the school grounds. Note the types of flowers and foliage, and determine their adaptability for use in the school border planting, screening, or for other purpose. Observe the landscaping and planting around the homes in the community to get ideas of attractiveness and desirability of different varieties. Nurserymen's catalogs picture varieties for various uses and include information and recommendations. Trips, "school journeys," to nearby nurseries will permit observation, bring inspiration, and prompt ideas.

5. Quality of Plants

Quality counts in plants. They should be sound, healthy, vigorous, free from plant diseases, insect pests or their eggs, and should have healthy normal root systems. Plants should be freshly dug and should not be heeled-in stock or from cold storage. These should have grown under similar climatic conditions as existing in the locality of the school ground or have been acclimated to the school locality for at least two years. No plants should be pruned before delivery. Plants, except collected materials, should be nursery grown and root-pruned at least once in the three years prior to delivery. Any collected plant that has not been root-pruned or transplanted one growing season before use in planting should have a larger ball of earth about the roots.

6. Handling and Moving

Digging and moving plants requires preparation. Plants in nurserymen's list marked "B & B" are usually adequately balled and burlapped with balls of proper diameter and of sufficient depth to include all the roots. Sometimes they are placed on "platforms" for moving. A plant is not acceptable when the ball of earth surrounding its roots has been cracked or broken preparatory to or during the process of planting; or when the burlap, staves, ropes or platform required in connection with its use have been broken. All balled and burlapped plants that cannot be planted immediately on delivery should be set on the ground and the balls well covered with soil, manure, or other protective material. Plants marked "P" in nurserymen's list are dug with bare roots and immediately after digging are "puddled" in mud of sufficient density to adhere to the roots after natural drying. Plants should be so handled that the roots are protected at all times. If delivery is made in an open vehicle the entire load should be covered with canvas during transportation. The canvas should not be so tight as to cause heating. On delivery all plants should be heeled-in. In heeling-in, all bundles must be opened and the plants separated before the roots are covered with soil, and care must be taken to have no air pockets remain among the roots. Plants, of course, should be properly marked for identification and checking. Each bundle of plants and all separate plants should have legible, waterproof labels securely attached before delivery. No plant should be bound with rope or wire at any time as to damage the bark, break branches, or destroy its natural shape.

7. Trees

Trees are woody plants. They are in one of two groups: deciduous, which lose their leaves at the end of each growing season, and evergreens, which shed their leaves so gradually as new leaves are formed that they appear continuously green throughout

the year. The deciduous group predominates in most localities in Pennsylvania. Evergreens such as pines, firs, and cedars, bearing cones and having slender needle-like or close scale leaves, are called conifers. Rhododendrons, mountain laurel, and holly are examples of broad-leaf evergreens.

Common trees of the locality are preferred for use in the landscape work because they are more readily available, better adapted to the soil and climate of the locality, and cost less than exotics. Moving selected plants from one location to plant them in another is called "transplanting." The types selected, care in moving, soil moisture, and climatic conditions are factors determining the degree of success in the operation of transplanting. Young trees usually are more successfully transplanted than old trees. Proper care in digging and handling trees up to three or four inches in diameter or caliper of trunk assists reasonable success in transplanting. Evergreens require very careful removal and handling. Cool, cloudy, windless days for transplanting are best. Trees that grow at the edge of a woods or grove are usually less effected by the change in shade and moisture conditions when moved from one location to plant in a different location.

8. Selection of Varieties

Varieties selected would include small trees and large trees. Small trees may be introduced occasionally at a corner of the building or where it will relieve blank wall space. The horizon or skyline can be varied; added interest can be given to border planting by the placement of individual small trees in such border. Small trees also may be arranged in naturalistic groupings and may be chosen from varieties of Flowering Crabs, Japanese Flowering Cherries, varieties of Hawthorns, and Flowering Dogwoods, either white or pink, possibly both. The Russian Olive of fine silvery foliage gives pleasing contrast. Large trees in the vicinity of the building may include the vase-shaped American Elm, White Oak, Pin Oak, Linden, Tulip Poplar, Sweet Gum, and Sugar Maple. Suitable locations for other specimens on the ground may be found for Bald Cypress, Hemlock, Austrian Pine, White Pine, Yellow Pine, Scotch Pine, Sour Gum, Sycamore, Sassafras, and Scarlet Oak.

9. Shrubs

Shrubs are distinguished from trees in the manner of branching, height, and shape of crown or top. Most shrubs instead of having a single trunk or stem have several stems or canes, are freely branching and seldom grow higher than twenty-five or thirty feet. Trees of considerable height can be recalled having the nearest branch higher above the ground than a shrub attains in its entirety. A tree such as a Willow, for example, under certain conditions may grow shrubby. Shrubs are usually propagated from seeds. They also

reproduce by root-sprouts and layering. In addition to natural means of propagating other methods are employed by making grafts and cuttings. Nursery grown stock proves best. Nursery practice and culture include root-pruning to secure a compact and well-branched root system. To dig and move such stock the root system is disturbed very little. The roots of plants that have grown for a number of years in one place, whether in the nursery or in a natural woods, have relatively few branches. The length of these root branches depends upon the distance they have extended from the plant in search of food and moisture. Failure in planting collected material is very often due to damaging, tearing, or breaking of the root system during collecting.

10. Varieties of Shrubs

Varieties of shrubs selected may include flowering horticultural plants. In the marginal borders naturalistic grouping of plants is preferable. Suitable material and choices can be made from Bladdernut, Chokeberry, Hazelnut, Red-stem Dogwood, Spicebush, Sumac, Winterberry, Witch-hazel, Wahoo, and Viburnum. Small trees, such as American Mountain Ash, Flowering Dogwood, Hawthorns, Juneberry, Redbud, and Sassafras, may rise out of the border planting. Suitable screen planting and border planting can be obtained by the use of taller vigorous shrubs such as American Cranberrybush, Arrowwood, Bell Honeysuckle, Cornelian Cherry, Downy Shadblow, Gray Dogwood, Lilac, Morrow Honeysuckle, Nannyberry, Ninebark, Pearl Bush, Shining Sumac, Siebold Viburnum, Smooth Sumac, Speckled Alder, Sweet Mock Orange, Sweetshrub, and Tatarian Honeysuckle. Smaller shrubs for use at and near the building may be selected from Blood-twig Dogwood, Carlesi Viburnum, Chokeberry, Coralberry, Fragrant Sumac, Goldflower, Hazel, Japanese Barberry, Jetbead, Kerria, Regel Privet, Shining Sumac, Snowberry, Spreading Cotoneaster, Sweet Pepper Bush, Weigela, Winged Burning Bush, Winter Honeysuckle, and Yellow-stem Dogwood.

XII. PLANTING OPERATIONS

Planting operations include the digging and preparing the ground to receive the plant materials, the actual planting of these materials, and completing the planting process.

1. Marking Areas—Prepare Pits

All plant areas should be staked on the ground in the locations and with outlines as shown on the planting plan before such areas are dug or prepared. All plant areas when dug should have vertical sides and crowned bottoms. Pits or holes for plants should be circular in outline. The earth taken from all plant areas should be removed from the property.

On the bottom of all pits a layer of manure one to two inches thick should be spread and then incorporated or worked into the bottom to a depth of four to six inches. Well-rotted, unleached barnyard or stable manure not less than six months and not more than two years old is very suitable manure. It should be free of sawdust, shavings, or other refuse, and should not contain more than twenty-five per cent of straw or other bedding material acceptable for landscape use. Manure added to the soil is for definite purposes, to supply better texture, more water holding capacity, greater air action, fermentation and its action on soil elements, and the introduction of very tiny or minute organisms known as bacteria which do the job of changing unusable compounds to usable forms. Working or forking the manure into the bottom of the pit merely gives the manure greater space for performing its functions. Add to this and lightly tamp a layer of topsoil at least one-inch thick or as much more as is necessary so that the ball or roots will rest on it when the plant is set to the finished grade of the plant area.

2. Placing Plants

Set all plants so that they have the same relation to the finished grade of their new location as they had to the ground surface of their previous location. The ground line can be recognized readily on the trunk or stems of plants with roots puddled or balled and burlapped. Plant each plant in topsoil in the center of the pit. Balled and burlapped plants should have topsoil tamped around the edges of the balls. All burlap, ropes, staves, etc., should be removed from the pit before filling in and no burlap should be pulled out from under balls. Roots of bare rooted plants should not be matted together, but should be arranged in their natural position and have topsoil worked in among them. Frozen or muddy topsoil should not be used for backfilling. Filling around trunks or stems should be avoided. All broken, frayed, or damaged roots should be properly cut off.

3. Planting Seasons

Planting seasons determine when to plant. Planting should be done in the spring season or in the fall season and varies with the type of tree and weather conditions. Deciduous trees should be moved during the dormant period—from the time season growth ends in the fall until just before root growth starts in the spring. Trees can be moved at any time if proper care is taken. The best time to move them is usually in the spring. The period extends from six weeks to two months, ending about the last of May and beginning as soon as the ground is dry enough to be dug and handled. The fall planting season can begin when the leaves commence to drop and extend until the ground starts to freeze. Evergreens as a rule require more care in planting than deciduous be-

cause their foliage must have a continuous and abundant supply of moisture. Evergreen planting can start when the leaves first appear on deciduous material and the period extends for about one month. It is not unusual to move large trees in winter with a frozen ball of earth. The pits to receive them generally are kept from freezing by protective covering of straw mulch and manure.

4. Tree Planting

Tree planting is accomplished by planting all plants in pits at least two feet greater in diameter than their ball of earth or spread of roots. The depth of the pits should be at least two feet and as much deeper as is necessary to accommodate the ball or roots and to permit the required preparation of the bottoms of the pits so that when the trees are placed in them there will be no necessity to raise or lower them to the finished grade. They will be at finished grade. It appears sensible to have trees face the same direction in their new location as they did in their previous location. When the trees have been properly set, topsoil should be backfilled in layers not more than nine inches thick. Each layer should be watered sufficiently to permit settling of the soil before the next layer is similarly treated. Enough topsoil should be used to bring the surface when settled to the finished grade. A mound of topsoil should be placed on the surface about each tree at the edge of the tree pit to produce a shallow saucer that will hold water.

5. Guying Trees

Guying and staking trees is needed to keep them in a firm position while the roots are securing proper anchorage to withstand being toppled over or thrown out of their upright positions by strong winds. Trees two and one-half inches or more in caliper, except those in play areas, those within four feet of surfaced areas and walks, and those between walks and curbs should be guyed. Each tree should have three guys of two strands of wire each. Guys should not come in direct contact with the bark of the tree at any place, but should be covered with pieces of rubber hose at points of contact. Guys should be located in such position that they will not pull crotches apart. The height at which guys should be attached to the tree should not be less than one and one-half times the distance from a ground stake or anchor to the center-line of the tree. Guys should be fastened to ground stakes. Stakes two inches by four inches and three feet long can be driven at an angle so that the point will be nearer the tree. The top of all stakes should be at least three inches below finished grade. In other words, the tops of the stakes will not appear above finished grade. A turnbuckle in each guy will aid it taking up slack and assist maintaining the proper position of the tree.

6. Support with Stakes

Staking of trees is required to support them in an upright position. Trees planted within four feet of surfaced areas or walks, between walks and curbs and all those less than two and one-half inch caliper in lawn and planted areas should be staked. Trees six inches or more in caliper usually require three stakes with bracing at the top of stakes. Trees between three and one-half inches to six inches in caliper are triple staked without top bracing. Trees two and one-half inches to three and one-half inches in caliper need double staking, that is, two stakes to each tree. These are spaced equally about the tree and driven vertically three feet into the ground about one foot from the tree trunk. The tree is then guyed to the top of each stake by double strands of wire through a rubber hose and looped about the tree. Trees eight feet or more in height and less than two and one-half inches in caliper are supported by one stake and guyed at the top of the stake with a double strand of wire in a figure eight loop. The loop about the tree is encased in the bark protecting rubber hose.

Wrapping the trunks of all trees two inches or more in caliper with burlap bandage should be done immediately after planting. The burlap is spirally wrapped in a neat and snug manner to the height of the second branches.

7. Shrub Planting

Shrub planting is done by placing the plants in individual pits. Delivered balled and burlapped shrubs are set in pits at least two feet greater in diameter than the ball of earth. Shrubs delivered with bare roots require a pit at least one foot greater in diameter than the spread of the roots. The depth of the pits should be at least one foot and as much greater as is necessary to allow the proper preparation of the bottom and to have sufficient room for the ball or roots when the plant is set at the finished grade. After setting the shrub in the center of the pit it is backfilled with topsoil and thoroughly settled by watering. A shallow saucer around each plant is then formed to hold water. When individual plants are arranged in a group, the spaces between the saucers should be filled with topsoil to the finished grade.

Beds in many instances have been prepared in advance of the planting of shrubs by digging to a uniform depth of one foot and backfilling the excavation with topsoil. The dirt removed being subsoil is taken away for disposal elsewhere. The planting of shrubs in separate holes then proceeds as previously indicated.

8. Pruning and Mulching

Pruning of all trees and shrubs immediately after planting is deemed helpful. Cutting off the tops of plants is butchering, but not pruning. When pruning the characteristic form of particular

plant materials is kept. The pruning operation will remove broken and damaged branches. All cuts over one-half inch in diameter should be treated with an approved tree paint. Plants can be thinned out by pruning without destroying their shape. The reduction of crown will assist the vigor and health of the plant.

Mulching, after the work of planting has been completed, is done by placing a two-inch layer of manure on the finished surface about all plants. Shrub beds are usually completely covered. Isolated shrubs and trees will have the mulch six inches greater in diameter than the pit.

The completion of planting operations allows consideration of the development of lawn areas.

XIII. LAWN DEVELOPMENT

The ground area of the entire site will be planted in lawn unless shown by the plans to be covered by plant materials; the building or other structures; walks, roads or other surfaced areas, or unless required to be treated otherwise.

1. Factors of Drainage and Soil

Two of the fundamental factors in developing lawns, drainage, and soil texture were recognized in the selection of the site requiring a property having good drainage and a sandy loam soil. It will be recalled that the topsoil was previously stripped and piled for later use. In grading the site, good drainage was not destroyed, but rather kept, if not actually bettered. Every means may be taken to encourage and sustain grass over impervious layers of clay, shale, rock or other materials but, if water collects and is not carried off by adequate drainage the grass will fail or die out in seasons of excess moisture. All desirable grasses for lawn use prefer well drained soils both at the surface and at the subgrade.

The lawn areas it will be recollected are at subgrade now. The soil in the area is subsoil. Lawn development requires preparation of the subsoil and preparation of the seed bed on it before sowing the seed.

2. Preparation of Subsoil

Preparation of the subsoil is required because subsoil usually lacks the necessary plant food elements and humus to support plant growth properly. After verification of the subgrade on the ground has been made by checking with the grading plan, a layer of manure, of the type previously mentioned, two inches in thickness, should be spread on the subgrade. Thorough incorporation of the manure with the subsoil should follow. After the manure has been incorporated the subgrade soil should be harrowed, well pulverized, and graded to remove all ridges and hollows. The surface will be

below and parallel to the finished grade. All stones over two inches in size, sticks, rubbish, or debris should be removed. After the preparation of the subsoil for lawn areas is finished, no heavy objects, except lawn rollers, should be taken over the surface unless adequate protection is provided.

3. Seed Bed Preparation

Preparation of the seed bed is necessary to assist germination of seeds and their growth. On the prepared subsoil surface, topsoil should be spread by hand or other approved method, and the area should then be rolled with a two hundred pound roller. Topsoil should not be spread in a frozen or muddy condition. The surface when finished and settled should conform to the finished grade and should be free from hollows or other irregularities and stones, sticks, or other debris.

4. Lawn Grasses—Fertile Soil

Lawn grasses prefer mildly acid to neutral soils. Excessive acidity is injurious to most grasses and tends to develop undesirable soil structure. Acidity can be corrected by the application of a neutralizing agent, hydrated lime, or finely ground limestone. Too much liming should be avoided, particularly on sandy soils. When applied it is better to incorporate it in the top few inches of soil.

Fairly fertile soil is required for the better grasses as a group. For sturdy plant growth the essential elements can be supplied by the addition of a complete commercial fertilizer. Fertilizer should be worked into the topsoil to a depth of four inches at the rate of 500 to 1000 pounds per acre. A reliable authority suggests the use of a mixed fertilizer containing five per cent nitrogen, ten per cent phosphoric acid, and five per cent potash. Nitrogen is necessary for the life and growth of the protoplasm of plant cells. Most plants obtain nitrogen in soil solutions in the form of nitrates. The lack of green color usually indicates not enough nitrogen. Grasses require nitrogen. Sulphate of ammonia and nitrate of soda are high in nitrogen content. Application of the fertilizer should be made several weeks before seeding to afford opportunity for thorough watering to settle the soil and to permit the germination and sprouting of weed seeds.

5. Planting Seasons—A Seed Mixture

Planting seasons for lawns vary. Late spring and summer seeding usually fails because quick growing annual weeds crowd out the grass or the grass is injured or burned out in hot dry weather. Fall plowing and careful weeding followed by late winter or early spring seeding is common in some areas. Fall sown grass starts growth early in the spring and has quite a start and is better able to compete with weeds as they appear.

The best all around grass seed generally is a mixture of varieties. Local inquiries can be made to obtain information. The country agricultural agent may have some experiences that may prove helpful and the State agricultural experiment station may be available for suggestions. An authority recommends a mixture by weight consisting of Chewing's fescue, thirty per cent; Kentucky bluegrass, twenty-five per cent; Colonial bent, fifteen per cent; Redtop, fifteen per cent and Perennial rye grass, fifteen per cent. Quality of seeds is represented by its purity and germination.

6. Sowing the Seed

Sowing the seed after lightly raking the prepared seed bed, to produce a smooth, loose, and pulverized surface, seldom requires more than 175 pounds of seed per acre. The quantity can be divided into two portions, one of which is evenly sown broadcast east and west and the other north and south over the same area. A wheelbarrow seeder may be used for seeding large areas unless hand distribution is preferred. After seeding, the area should be lightly rolled once and followed by a thorough watering with a fine spray carefully done to avoid washing out the seed.

Seeding should not be done after a rain without loosening the surface of the ground. A velocity of wind greater than a gentle breeze or blowing at a greater rate of about five miles per hour prevents proper seeding. Care should always be taken not to change the grade of the finished surface. Plantings which are made in moderately moist soil in the right season with normal rainfall will usually be successful. Grass seed germinates in about four weeks. The plants are very tender and every rain causes the formation of a crust on the surface. To avoid crusting, the surface can be kept soft by watering with a very fine mist-like spray. Excessive watering should be avoided.

Rainfall may be supplemented by watering if needed, to protect young grass plants against drought. Occasional thorough soakings are better than frequent light sprinklings. Light sprinkling encourages undesirable shallow rooting and the plants suffer in periods without moisture.

7. Lawn Care

Lawn care consists in supplying water to keep lawn areas moist at all times to secure proper germination of the seed and growth of the young plants. Spots or areas which are bare and show no catch of grass should be reseeded at intervals of ten days until a good growth has been established and the entire lawn area has an even thick growth of grass. After seeding it is advisable to protect the lawn area from trampling. Stakes at frequent intervals at the edges of lawn areas with wire stretched across their tops fastened with staples have furnished adequate protection against foot damage. When the grass is well established the guards can be removed.

XIV. MAINTENANCE

The school ground has been developed and is now a living and growing expression of community enterprise. The planning, designing, development, construction, and planting of the school ground is no mean accomplishment. Maintenance is necessary to continue this praiseworthy achievement. The only constant of the entire property is change. Operations of maintenance are many and depend particularly on their necessity. Maintenance operations include watering, weeding, cultivating, pruning, thinning, spraying, mowing, trimming, feeding, edging, mulching, and other operations.

All planting should be kept in a healthy growing condition. During the summer months, or periods of drought, watering is required. Pruning is resorted to from time to time to remove dead and broken branches. Resetting of plants is done to avoid crowding and to permit materials to grow in their natural form. Watch lawns for weeds, dandelions, and crab grass. Remove them, plant and roots. Rolling the lawn with a heavy roller after the last frost in early spring will restore to an even surface such portions heaved by frost action. Brown spots in the lawn may require the addition of lawn grass food. Reseeding should be done when correction can be had that way. Occasional inspections will detect the presence of scale and may be remedied by spraying with the proper oil spray. Insect pests can be controlled by spraying. The liquid used depends on the kind of pest. Chewing insects require one kind and sucking insects require a different spray. Shrub beds need cultivating or tilling, mulching, and edging. Dead shrubs should be removed and replaced. No matter what the operation may be it does appear that maintenance is always in order. The practice of maintenance may be daily, weekly, seasonal, regular or occasional, but in general, maintenance is continual.

XV. CONCLUSION

The only time work on the school ground is completed is when the property ceases to be a school ground. The development can be extended over a period of years. The work can be divided into various units and accomplished a unit at a time. Cooperation of the community and participation in the development by every individual in the community is attainable. The infant in its mother's arms unclenching a tiny handful of soil into a tree pit during a community tree planting exercise, later as a pupil in the school, can be grateful for having had a part in the construction. Each individual can help in some way and benefit immeasurably from such giving to the school grounds; its planning and planting.

The influence of the school ground spreads and to the credit of the community. No one person can tell what it will mean to the community, the county, Pennsylvania, and the nation, when there is—Every School in a Park.

(Concluded from inside front cover page)

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